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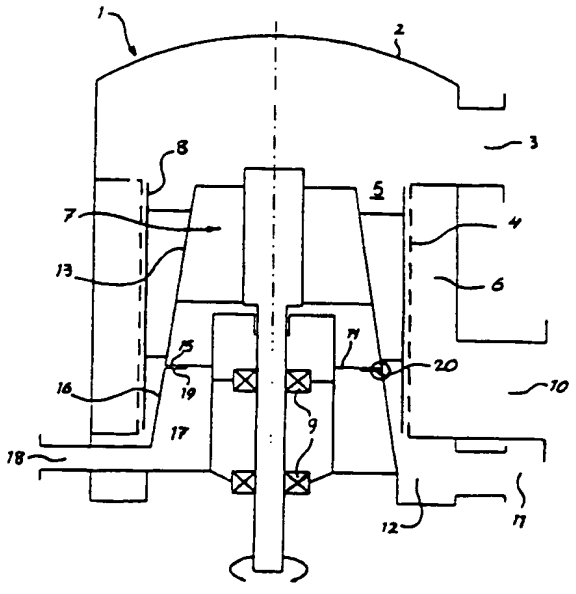
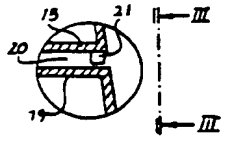
(54) Title: SCREENING APPARATUS WITH DILUTION LIQUID SUPPLY MEANS

(57) Abstract

A screening apparatus (1) for separating fibre suspensions comprises a stationary tubular screen (4) for receiving a fibre suspension to be separated at one end of the screen, a rotor (7) coaxial with the tubular screen, and dilution liquid supply means (15–20) for supplying dilution liquid to the central chamber to dilute a developed thickened reject fraction of the fibre suspension. The dilution liquid supply means comprise a rotationally symmetrical element (15) of the rotor (7) and an opposite stationary annular wall portion (19) defining an annular passage (20) therebetween for the dilution liquid.





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Screening apparatus with dilution liquid supply means

The present invention relates to a screening apparatus for separating fibre suspensions, comprising a housing, an inlet to the interior of the housing for a fibre suspension to be separated, a stationary tubular screen dividing the interior of the housing into a central chamber for receiving the fibre suspension from the inlet at one end of the tubular screen and an outer accept chamber for receiving an accept fraction of the fibre suspension, which has passed through the screen, a rotor journalled on the housing and situated in the central chamber coaxially with the tubular screen, and a reject chamber for receiving a developed reject fraction from the other end of the screen. The apparatus further comprises dilution liquid supply means for supplying dilution liquid the central chamber.

Such an apparatus is generally used for separating paper pulp suspensions, for instance for fractionating fibres or for separating contaminants and other undesirable particles, such as incompletely treated fibres. A well-known problem in connection with the separation of a pulp suspension by this type of apparatus is that the pulp suspension in the central chamber has a higher fibre concentration relatively close to the reject passage than relatively close to the end of the tubular screen where the pulp suspension to be separated enters the screen. This is due to the fact that the liquid, usually water, in the pulp suspension easily separates through the screen immediately after having entered the tubular screen. As a consequence the developed reject fraction is thickened in the vicinity of the reject passage. This thickening of the reject fraction is further increased if just a relatively small flow of the reject fraction is allowed to escape through the reject passage. A too large thickening of the reject fraction gives rise to torque transmission between the rotor and the screen via the thickened reject fraction, which results in an increased energy consumption for rotating the rotor. The rotor might even get stucked to the screen, which requires a costly production break for manual cleaning of the rotor and the screen. The thickened reject fraction might also be difficult

to discharge through the usually narrow reject passage and further through a valve situated outside of the apparatus.

U.S. Patent No. 4749474 discloses an apparatus of the above described type in which the dilution liquid supply means is adapted to pump dilution liquid from a reject chamber of the apparatus into the central chamber against the flow of developed reject fraction, to counteract the thickening of the suspension along the screen. A disadvantage of this known apparatus is that the apparatus produces a final reject fraction that has an unsatisfactorily low consistency, because the reject fraction is mixed with a significant volume of dilution liquid in said reject chamber.

WO 93/23609 discloses another apparatus of this type in which the dilution liquid supply means comprise a complex pipe system arranged on the rotor for rotating therewith while flushing jets of dilution liquid through pipe openings against the screen. However, it has been proved that such dilution liquid openings on the rotor often are clogged with fibres with the consequence that the operation of the apparatus has to be interrupted for cleansing of said openings and removal of thickened reject fraction deposited on the screen.

The object of the present invention is to provide a screening apparatus with reliable dilution liquid supply means, which insignificantly affect the consistency of the final reject fraction.

This object is achieved by an apparatus of the type described initially, which is characterized in that the dilution liquid supply means comprise a rotationally symmetrical element of the rotor and an opposite stationary annular wall portion, said element and wall portion defining an annular passage for the dilution liquid. Since said rotor element moves along the stationary annular wall portion during operation of the screening apparatus, any particles present in the annular passage will be subjected to shearing actions by the rotating rotor element, which significantly reduces the risk of the

annular passage being clogged with fibres or contaminants.

To further reduce said clogging risk, the rotationally symmetrical element may be provided with at least one protrusion, which extends in the annular passage but is spaced from the stationary wall portion. During each revolution of the rotor the protrusion will push away any particles present in the annular passage. As an alternative, or in combination with said protrusion, the axial width of the annular passage may vary in the circumferential direction, so that the liquid present in the annular passage will be subjected to a pulsating action by the rotor element during operation.

The annular passage suitably opens into the tubular screen, preferably at a distance from said other end of the screen which is about 5-50% of the axial length of the screen. As a result, the dilution liquid can directly flush the desired location of the screen, so that no excessive volume of dilution liquid is supplied to the central chamber.

According to a preferred embodiment of the invention, the rotor comprises a circumferential wall and a radial wall connected to an end of the circumferential wall, the rotationally symmetrical element forming part of said radial wall. The dilution liquid supply means comprise a stationary circumferential wall in flush with the circumferential wall of the rotor and connected to the stationary annular wall portion, the stationary circumferential wall and annular wall portion defining a dilution liquid chamber in fluid communication with the annular passage. To provide favourable flow conditions in the central chamber, the circum-ferential walls of the rotor and the liquid supply chamber taper in the direction toward said one end of the screen. As a result, the above preferred embodiment comprises a simple inexpensive and reliable dilution liquid supply means.

The invention is described in more detail in the following with reference to the accompanying drawing, in which

Figure 1 is a longitudinal cross-section through a schematic screening apparatus according to a preferred embodiment of the invention,

Figure 2 shows an enlarged encircled detail in Fig. 1, and

Figure 3 is a view along line III-III in Fig. 2.

In Fig. 1 there is shown a screening apparatus 1 of the invention comprising a generally cylindrical housing 2 with an inlet 3 for a fibre suspension to be separated, and a cylindrical screen 4 secured to the housing 2 and dividing the interior of the housing 2 into a central chamber 5 for receiving the fibre suspension from the inlet 3 at one end of the cylindrical screen 4 and an annular outer accept chamber 6 for receiving an accept fraction of the fibre suspension, which has passed through the screen 4. A rotor 7 provided with a number of circumferentially distributed peripheral wing elements 8 is journalled by bearings 9 on the housing 2 and positioned in the central chamber 5 coaxially with the cylindrical screen 4, so that the wing elements 8 sweep past the interior surface of the screen 4, when the rotor 7 is rotated by a drive motor (not shown). The housing 2 is provided with an accept outlet 10 for discharging the accept fraction from the accept chamber 6 and a reject outlet 11 for discharging the developed reject fraction from the interior of the screen 4 via a reject chamber 12 communicating with the central chamber 5.

The rotor 7 has a truncated conical circumferential wall 13 and a radial wall 14 connected thereto at the base of the conical wall 13. At the connection between the walls 13 and 14, a part of the radial wall 14 is formed by a rotationally symmetrical wall element 15 of the rotor 7.

A stationary truncated conical wall 16, which is coaxial and flush with the conical wall 13 of the rotor 7, defines a dilution liquid chamber 17 with an inlet 18. At the apex end of the conical wall 16 an annular wall portion 19 extends radially inwardly from the conical wall 16 adjacent the wall element 15 of the rotor 7, so that a narrow annular passage 20 is defined between the wall element 15 and the wall portion 19. The wall

element 15 of the rotor 7 is provided with at least one protrusion 21, which extends in the annular passage 20 but is spaced from the stationary wall portion 19. The annular passage 20 opens into the tubular screen 4 relatively close to the reject chamber 12. To achieve a satisfactory dilution of thickened reject fraction, the passage 20 should open into the screen 4 at a distance from the reject discharging end of the screen 4 which is about 5-50% of the axial length of the screen 4.

Thus, the screening apparatus is provided with dilution liquid supply means comprising the above defined wall element 15, stationary circumferential wall 16, dilution liquid chamber 17 with its inlet 18, annular wall portion 19 and annular passage 20.

In operation, the fibre suspension to be separated is supplied to the central chamber 5 through the inlet 3 and flows along the screen 4 while separating into an accept fraction, which passes through the screen 4 into the accept chamber 6 and discharges therefrom through the accept outlet 10, and a reject fraction, which flows from the screen 4 into the reject chamber 12 and discharges therefrom through the reject outlet 11. By pulsating action of the rotating wing elements 8 the screen 4 is prevented from being clogged by fibres and/or contaminants. Dilution liquid, usually water, is supplied to the dilution liquid chamber 17 via the inlet 18. From chamber 17 the dilution liquid flows past the annular wall portion 19 and through the annular passage 20 flushing the screen 4, so that detrimental thickening of the reject fraction is prevented.

The annular passage 20 is kept clean by the rotation of the wall element 15 subjecting any particles present in the annular passage 20 to shearing actions. In addition to this, the protrusion 21 on the rotor 7 pushes away any particles present in the annular passage 20 during each revolution of the rotor 7.

Claims

1. A screening apparatus (1) for separating fibre suspensions, comprising a housing (2), an inlet (3) to the interior of the housing for a fibre suspension to be separated, a stationary tubular screen (4) dividing the interior of the housing into a central chamber (5) for receiving the fibre suspension from the inlet at one end of the tubular screen and an outer accept chamber (6) for receiving an accept fraction of the fibre suspension, which has passed through the screen, a rotor (7) journalled on the housing and situated in the central chamber coaxially with the tubular screen, a reject chamber (12) for receiving a developed reject fraction from the other end of the screen, and dilution liquid supply means (15-20) for supplying dilution liquid to the central chamber, **characterized** in that the dilution liquid supply means comprise a rotationally symmetrical element (15) of the rotor and an opposite stationary annular wall portion (19), said element and wall portion defining an annular passage (20) for the dilution liquid.

2. A screening apparatus according to claim 1, wherein the annular passage (20) opens into the tubular screen (4).

3. A screening apparatus according to claim 2, wherein the annular passage (20) opens into the screen (4) at a distance from said other end of the screen which is about 5-50% of the axial length of the screen.

4. A screening apparatus according to any of claims 1-3, wherein the rotor (7) comprises a circumferential wall (13) and a radial wall (14) connected to an end of the circumferential wall, the rotationally symmetrical element (15) forming part of said radial wall (14).

5. A screening apparatus according to claim 4, wherein the dilution liquid supply means comprise a stationary circumferential wall (16) in flush with the circumferential wall (13) of the rotor (7) and connected to the stationary annular wall

portion (19), the stationary circumferential wall (16) and annular wall portion (19) defining a dilution liquid chamber (17) in fluid communication with the annular passage (20).

6. A screening apparatus according to claim 5, wherein the circumferential walls (13,16) of the rotor (7) and liquid supply chamber (17) taper in the direction toward said one end of the screen (4).

7. A screening apparatus according to any of claims 1-6, wherein the rotationally symmetrical element (15) is provided with at least one protrusion (21) extending in the annular passage (20) but spaced from the stationary wall portion (19).

8. A screening apparatus according to any of claims 1-7, wherein the axial width of the annular passage (20) varies in the circumferential direction.

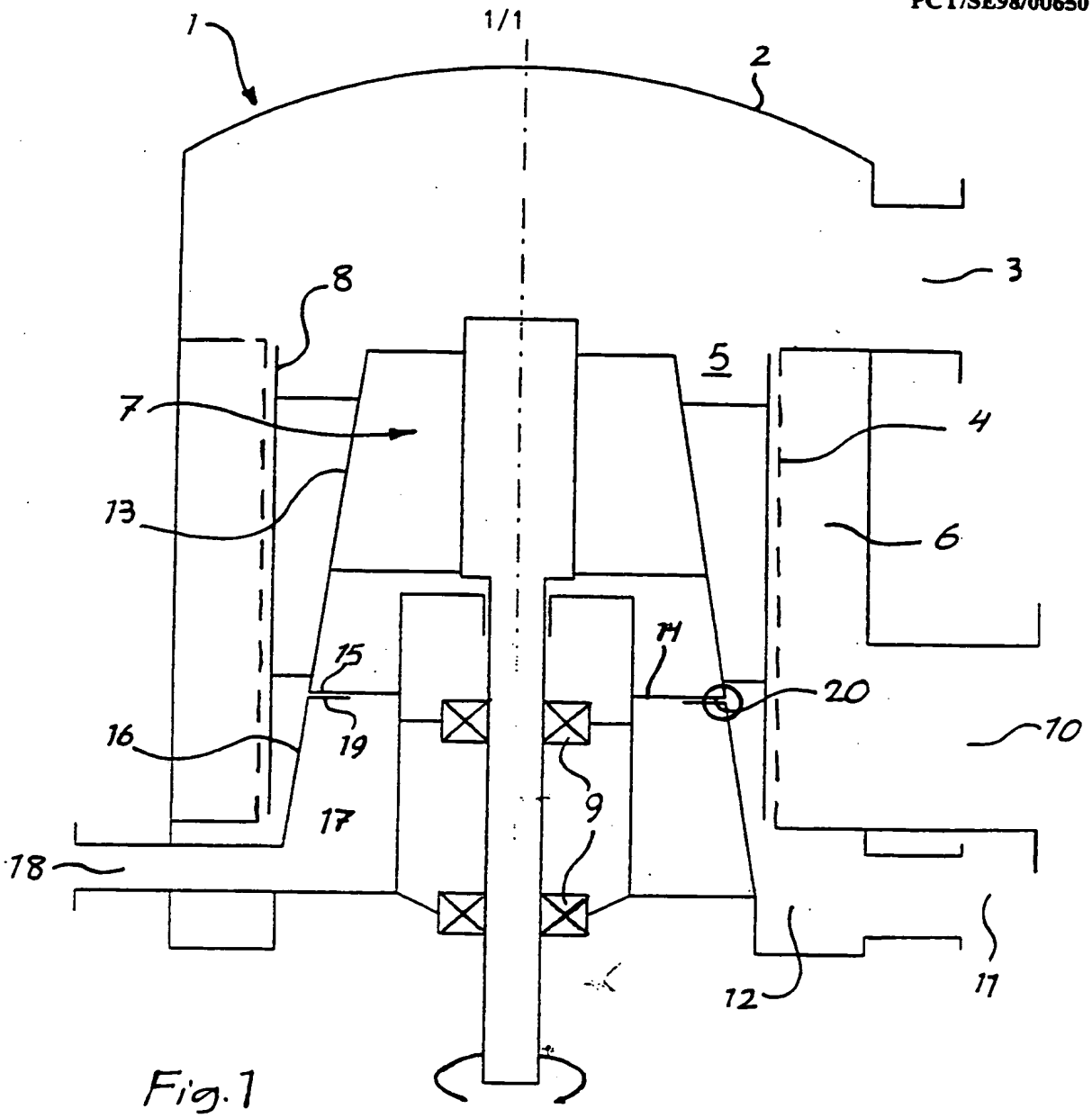

Fig. 1

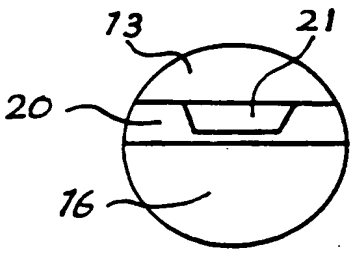

Fig. 3

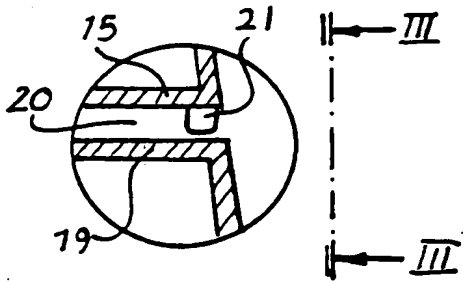

Fig. 2

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 98/00650

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: D21D 5/02
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: D21D

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 507905 C2 (SUNDS DEFIBRATOR INDUSTRIES AB), 27 July 1998 (27.07.98), abstract --	1
A	WO 9323609 A1 (POM DEVELOPMENT OY AB), 25 November 1993 (25.11.93), abstract --	1
A	EP 0649940 A1 (ISHIKAWAJIMA-HARIMA JUKOGYO KABUSHIKI KAISHA ET AL), 26 April 1995 (26.04.95), figures 3,7, abstract --	1
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